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## **ABSTRACT**

### **Evaluation of the Effect of a Web-Based Automated Mental Health Intake System on Parent and Provider Satisfaction**

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**Background:** The Child and Adolescent Psychiatry Service (CAPS) at the Walter Reed Army Medical Center (WRAMC) provides in-clinic consultation and telepsychiatry services for the North Atlantic Regional Medical Command. To facilitate the enrollment of new patients, the Department of Telemedicine and CAPS developed a secure Web-based Automated Mental Health Intake System (WAMHIS) to replace the traditional paper-based intake system. Parents/guardians were able to complete intake forms online days before the initial appointment in their home or at work allowing providers to access and review the completed forms well in advance of the appointment to prepare for the interview.

**Methods:** The research questions were developed to determine how feasible the automated system was in clinical practice and how satisfied parents and providers were with the automated system compared to the manual system. CAPS recruited 90 parents of new child and adolescent psychiatry patients and assigned them to one of the following 3 groups: Group 1 parents completed intake forms online from home or work prior to the appointment, Group 2 parents completed the intake forms online in the CAPS clinic at the time of the appointment using a clinic computer and Group 3 parents completed the traditional paper-based intake forms at the time of the appointment. Parents in Groups 1 and 2 completed an automated satisfaction survey with the automated information forms, and parents in Group 3 completed a paper satisfaction survey with the manual patient information forms. After the intake appointment, parents in all groups completed a survey measuring overall satisfaction with clinic services.

To measure provider satisfaction with the intake system, CAPS providers were recruited to complete the following surveys for each participating new patient enrolled in the study: Provider Survey #1 (Post-Interview) and Provider Survey #2 (Post-Report). A provider completed Provider Survey #3 (Initial Satisfaction and Demographics) once, after he/she wrote their first intake report online using the automated system.

**Results:** Parents completing the online forms were more satisfied when compared to parents completing the paper forms. After their first use of WAMHIS, providers were moderately satisfied with the automated system (55%). Improvements to WAMHIS were ongoing throughout the study time period, so by the end of the study, providers had much higher satisfaction with the automated system (85%). There was an approximately 15-minute decrease in patient/parent time at the clinic for parents who completed the online forms from home, and a reduction in time spent waiting to see the provider due to paperwork. When parents used WAMHIS at home, providers had more time to review the intake forms and prepare for the actual appointment. As a result, providers noted an increase in clinical efficiency in 94% of the diagnostic interviews.

**Conclusions:** Data analysis suggested that the web-based system has improved impact on quality of care, access to care and has enhanced outcomes measurement and clinical practice

objectives by 20 percent. This study serves as a model for future web-based initiatives in mental health care environments.

## **BODY**

### **Project Description:**

The Child and Adolescent Psychiatry Service (CAPS) of the Walter Reed Army Medical Center (WRAMC) initiated a web-based automated mental health intake system (WAMHIS) to replace the more traditional paper-based intake system. [Please note: throughout this report, WAMHIS shall be referred to as the *automated system*, and the paper-based forms shall be referred to as the *manual system*]. This project determined how feasible the automated system was in clinical practice and how satisfied parents and providers were with the automated system compared to the manual system. The proposed benefits of this project included the following:

- Improve continuity of care through virtual record keeping.
- Save time for both health care providers and parents.
- Increase clinical efficiency.
- Achieve compliance with JCAHO (Joint Commission on Accreditation of Healthcare Organizations) and professional organization requirements in a Telepsychiatry environment.
- Increase number/percentage of fully completed forms.
- Increase readability, legibility and understandability of intake forms.
- Facilitate focused interviews with typed intake data and prevent redundancy and repetition of information.
- Provide baseline data to track and measure treatment progress and clinical outcome using clinical database.
- Facilitate research efforts with the centralization of clinical data.
- Increase overall quality of care.
- Increase overall access to care.

### **Military Relevance**

WAMHIS provides an easily transportable patient record, which is particularly important as families PCS (Permanent Change of Station) and enroll to other Medical Treatment Facilities (MTFs). This system enhances access to child and adolescent psychiatry and telepsychiatry services, reduces overall time in the clinic for families (e.g., reduced wait time) and increases parent satisfaction with the intake process. Use of the system reduces time away from duty assignments for Active Duty parents and time away from school for the student patient. The use of a web-based system also expands access to care from distant sites. This is particularly beneficial when a parent is deployed or stationed at remote duty sites. This web-based psychiatric intake complies with military clinical information standards and JCAHO.

### **Definitions:**

**Automated Report-writer:** Automated formatting and printing of the data provided by the parents prior to the intake interview. The provider has access to this organized information prior to the actual appointment.

Automated System: A short name for WAMHIS.

Clinical Database: A secure database containing patient clinical information/data extracted from clinical patient information forms.

Client population: Children and adolescents seeking treatment from the CAPS; intake information is provided by parent(s) and/or guardians.

Intake interview: The initial appointment involving interviews with parent(s) and patient by one or more providers on intake team. Optimally this occurs during duty hours in the CAPS Clinic and includes team discussion, treatment planning and feedback to parents.

Intake process: The procedure used to gather initial data from a new patient and empanel that individual into the clinic caseload. Intake begins with the patient's initial referral to CAPS, includes completion of patient information forms using one of the intake systems, completion of the intake interview, and ends with completion of the intake report by the CAPS provider.

Intake report: A handwritten or typed document that includes patient demographics, history of presenting problem, individual and family bio-psycho-social information, clinician assessment based on interview with patient and parents, formulation, differential diagnosis, and initial treatment plan.

Intake system: Mechanism for completing the patient information forms; web-based or manual.

Patient information forms: Demographic, medical, psychosocial questions answered by parent(s) using the manual process or the automated process under development; includes intake form, symptom checklists, and Ohio Scales Outcomes Measure.

Research Database: A separate small, secure database constructed for this study containing de-identified data from surveys to be described in protocol. Information for this database is provided by parents and participating providers.

Research Population: Parents & guardians of the children and adolescents being served at CAPS and their participating providers.

Web-based Automated System: Another name for WAMHIS.

### **Intake Process: Manual System**

The clinic's manual intake process has traditionally relied on the parent(s) to first provide a brief description of the child/adolescent's problems over the telephone. Next, the parent spent approximately 60 minutes in the waiting room prior to the initial appointment completing a 28-page paper intake form, which included an intake form (e.g., includes demographics, historic and medical information), symptom checklist, and Ohio Scales Outcomes Measure. The parent typically repeated nearly all of the information verbally to the provider due to the lack of time for the provider to review the handwritten forms prior to the intake interview. The total time necessary to minimally complete the intake process (i.e. patient demographics, medical/psychosocial history, interview with parents/patient, differential diagnosis and disposition) usually lasted 2 or more hours and often required multiple visits, since the first visit was used to gather background information.

Following the initial interview the provider utilized an additional hour (at least) retyping and editing the handwritten patient information forms and his/her notes taken during the interview in order to produce the intake report. The redundant and time-consuming nature of this process was a universal source of frustration for both parents and providers, resulting in persistent dissatisfaction with the intake process and an overall clinical inefficiency.

Due to the time required to collect the intake information within the clinic, the use of valuable symptom severity measures ("pre-tests") was often omitted. Without these baseline measures, later documentation of symptom improvement and clinical outcomes was virtually impossible or, at best, incomplete (Burlingame, Lambert, Reisinger, Neff & Mosier 1995). These systemic inefficiencies in CAPS occur in many behavioral health settings in both military and civilian settings. Historically, behavioral health disciplines have lacked adequate systems of collecting patient outcome data resulting in a persistent inability to demonstrate the efficacy of treatment (Brugha & Lindsay 1996).

### ***Intake Process: Automated System***

The automated intake system used web-enabled versions of the patient information forms that parents currently completed on paper. The research team anticipated that parents would feel less time pressure because they would have access to the patient information forms well in advance of the initial appointment and flexibility to complete the forms at their convenience. The study expected that parents and patients would spend less time in the clinic and that the actual time spent would be better utilized. Form completion online at least 48 hours before the initial appointment allowed providers to review the automated report containing relevant clinical information. The research team anticipated that the prepared provider could better focus the interview based on advanced receipt of information in the automated report generated from online completion of the forms. This would eliminate redundant questions and increase diagnostic precision by providing time for focused symptom exploration and use of symptom severity measures. According to the research team, these improvements in clinical quality and efficiency should translate into an increase in parent satisfaction with the overall intake process.

The automated system incorporated existing, but inconsistently used symptom assessment instruments and baseline measures. These would improve and standardize baseline patient assessment as well as standardize the monitoring of longitudinal outcome measures. These instruments were computer-scored and the results were incorporated into the initial automated report. The automated system also allowed for easier monitoring and periodic retesting of symptoms at intervals during the treatment process which, combined with the initial baseline measures, yielded much more meaningful measures of treatment efficacy and clinical outcome for patients.

The automated system complied with military clinical information standards. In a new set of rules proposed on 1 August 2000, the General Services Administration encouraged federal agencies to move from paper forms to electronic records. The automated system assisted the military in bringing medical information-gathering technologies into compliance with the Government Paperwork Elimination Act (GPEA) of 1998, which required government agencies to transfer all information electronically by October 2003 (see <http://www.whitehouse.gov/OMB/fedreg/gpea.html> ).

The automated system also has considerable applicability in the field of telemedicine. Telemedicine is the use of video conferencing technologies to provide clinical services at distant sites that lack local specialty care. The expanding use of these technologies in mental health increased the need for secure, automated, web-based clinical intake systems to replace traditional systems that currently rely on mail or fax. The automated process of this study provided a secure and effective tool for obtaining and managing clinical information for patients/families served through telepsychiatry as well.

***Research Database for this Project:***

The study protocol evaluated the automated system and required an additional, separate, password protected database (called the “*research database*” in this paper) in order to keep research data segregated from routine clinical data. The patient clinical data (including information from the patient information form, symptom checklists, and Ohio Scales Outcomes Measure) was kept in the **clinical database**, accessible only to clinicians from within the WRAMC intranet. This database, which existed prior to the study, did not contain research data, and was not addressed within the original research study protocol.

The data from completed research questionnaires and the other information needed for the research covered by this protocol were kept in the completely separate **research database** accessible only by the research team within WRAMC. Once all of the data elements for participants were entered into the research database, that individual’s identifying data (or the data linking the research and the clinical databases) were encrypted such that a new protocol would have to be submitted in order for the encryption key to be released for other research projects.

***Literature Review:***

While the business community has studied client satisfaction and automated web-based information gathering extensively, there is a paucity of empirical data regarding the use of web-based clinical healthcare data acquisition systems. One study performed in the field of sports medicine (Peltz, Haskell, & Matheson, 1999) examined the administration of a “preparticipation exam.” This exam included a medical and sports history. When administered manually, participating physicians found the preparticipation exam to be “labor intensive” while offering few indicators of “future injury or illness.” Once implemented on the World Wide Web, participating physicians felt the web-based version of the exam improved both quality of medical care and “physician time efficiency.” In fact, 94% of the providers in the study “found improvement in their ability to provide overall medical care including health issues beyond” the scope of the intent of the questionnaire, and 81% also noticed a “decrease in time needed for each ... exam.” Additionally, physicians who generated reports by the web-based application found an improved “ability to provide overall medical care.” Furthermore, 90% of study participants who accessed the exam on the web found it “easy” or “moderately easy” to access and complete. Overall, this study provides evidence of increased provider/participant satisfaction when a web-based application was used in place of the traditional paper forms.

In the studies by Bell & Kahn; Hasley; Hibbert, Hamill, Rosier et al; Miatland & Mandel; Paperny, Aono & Lehman; Roizen, Coalson, Hayward, et al; Taenzer, Specia, Atkinson, et al; and Turner, Ku, Rogers, et al (as cited in Peltz, Haskell & Matheson, 1999), the evidence “show[ed] that computerized questionnaires collect health information more efficiently and with equal or greater accuracy.” Additionally, the research of Hasley; Paperny, Aono & Lehman; Turner, Ku, Rogers, et al (as cited in Peltz, Haskell & Matheson, 1999) showed that computer-based questionnaires are effective at collecting “honest responses to sensitive health issues and risk behavior questions.” This is a critical feature that can make computer-based questionnaires a useful tool for mental health professionals.

A number of studies have compared *online surveys* of computer user satisfaction to *paper and pencil surveys*. One study compared the use of an online automated version to paper and pencil version of the Questionnaire for User Interaction Satisfaction (QUIS 5.5). This study found the two versions were equivalent as rating instruments and the computer version was superior at eliciting specific user feedback about the experience of the “human/computer



interface" (Slaughter, Harper and Norman, 1994). The latter finding is important to software developers who rely on user feedback to spot problems and design flaws in programs. A second study performed by the same group (Harper, Slaughter and Norman, 1998) tested reliability and validity of a newer version of the QUIS using a web-based survey. This study concluded that the web-based administration of the survey was far superior in terms of cost and time-savings to previous methods. These earlier methods required the computer version of the survey for each platform and different operating systems.

Additional advantages of using the web included the following: automatic data collection from multiple users at multiple locations, automatic formatting that eliminated costly and error-prone data entry and rapid automated statistical analysis of the data. Another study (Pouwer, Snoek, Ploeg, Heine, & Brand, 1998) compared paper versus personal computer administration of the Well-being Questionnaire (WBQ) and the Diabetes Treatment Satisfaction Questionnaire (DTSQ). Although 58% of the subjects reported that they rarely, if ever, used computers, 99% stated that the questionnaires were "easy or very easy" to fill out. Furthermore, the authors concluded that scale scores obtained by computer were equivalent to those obtained with paper forms.

Two additional articles discussed the development of electronic patient-care systems. One article describes a computer-assisted assessment, psychotherapy, education and research (CAPER) system (Weaver, Sells, & Christensen, 1996). The other article describes NUCLEUS, a project in the AIM program (A2025), which strives to create a standardized foundation for integrated health records customized for individual institutions. However, neither article contained any reference to research examining the effectiveness of these systems. Thus, while a number of data collection applications exist on the web, there is limited research looking at end-user (provider and client) satisfaction and data comprehensiveness. Our research study protocol aims to provide information on the evaluation of end-user satisfaction and data comprehensiveness.

In their study of patient satisfaction with health care, Sitzia & Wood (1997) identified a number of variables that can influence patient/parent satisfaction with the provision of clinical services. These variables include age, ethnicity and education. Advancing patient age (and by extension to children's services, the age of parents or guardians) has shown a strong direct correlation with increased compliance and satisfaction. Likewise, ethnicity has also been shown to play a significant role in satisfaction, with Caucasians generally more satisfied with their general level of medical care than people from other ethnic backgrounds. In contrast, patients who have attained higher levels of education and income have shown a strong inverse correlation with rates of compliance and satisfaction. Participants of the study outlined in this report were surveyed to determine their level of comfort with computers. The research team believes that this data will help us understand users' responses to the WAMHIS system.

This study utilized the IBM Computer Usability Satisfaction Questionnaire, an instrument developed to evaluate computer usability. This questionnaire had acceptable psychometric properties and could be employed as standardized measurements of satisfaction for usability studies and tests (Lewis, 1995). Despite an exhaustive search we were unable to find examples of validated clinical provider satisfaction surveys. We have therefore constructed our own survey to examine the key elements of provider satisfaction with the automated system utilized in this study.

## **Study Design and Methods**

### **Technology Used:**

WAMHIS is a web-based data collection system that allows parents to use the Internet from home and/or work to securely provide clinical information. It then organizes the collected data and migrates the automated report to the provider to aid diagnosis and evaluation. The technical features of this system include 128-bit encryption and secure-socket technology for transmission of clinical data from completion of on-screen forms to a SQL database on a secure server at WRAMC. This system was not intended to replace or duplicate existing computer database systems such as CHCS (Composite Health Care System) or CIS (Clinical Information System), but was intended to automate patient clinical information gathering and to generate initial provider reports. This system attempted to maximize the use of technology for gathering clinical information prior to initial patient contact.

### **Subjects:**

Parents: The first group of research participants included the parents/guardians of new patients seeking services in the Child and Adolescent Psychiatry Service (up to age 18). The parents and providers will provide all of the research data.

Providers: The second group of research participants included the providers who interviewed the new patients of the participating parents/guardians. These providers (excluding investigators) were invited to participate in the provider portion of this study. There are approximately 25 providers treating patients in the CAPS clinic. Investigators conducting this study were not eligible for participation. To address provider satisfaction, we sought to invite/enroll and consent up to 15 providers.

In total, we requested permission to enroll up to 90 parents and up to 15 CAPS Clinic providers for this feasibility study.

### **Consent Process:**

Parents: The CAPS research assistant mailed a cover letter describing the study, a copy of the consent form and a WAMHIS User Guide to all parents making new initial appointments. The research assistant then called the family using a standard telephone script to receive verbal consent to participate in the study. During this phone conversation, parents were able to ask questions or voice any concerns before consenting to participate. Once verbal consent was obtained, the research assistant sequentially assigned the family into one of the 3 parent groups as follows:

- *Group 1:* The parents placed in Group1 completed the patient information forms from their own off-site computers. They were given the URL to access the site when they fully read and understood the cover letter and consent form. Furthermore, the parent was unable to begin the automated process until he/she signed the consent form. The parent was reminded that they must have signed the consent form before accessing the patient information forms by a bulleted statement at the top of the first web page of the automated system. The research assistant reviewed the consent form with the parent once again at the initial appointment and was available should the parents have additional questions.

- *Group 2:* Parents placed into Group 2 completed the patient information forms on a computer in the CAPS clinic. They were asked to arrive 60 minutes prior to their child's appointment (standard clinic practice). Upon arrival, the research assistant reviewed the consent form with the parent/guardian. CAPS staff members and the research assistant answered any questions he/she may have had, and the research assistant witnessed the necessary signatures. Finally, the parent completed the automated process on a dedicated and secure computer terminal located in the CAPS clinic.
- *Group 3:* The parents placed into Group 3 completed the patient information forms using the manual system (paper and pen method) in the clinic. They were asked to arrive at the clinic 60 minutes prior to their child's appointment (standard clinic practice). They were given the paper consent form upon arrival to the clinic, which the research assistant reviewed with them. CAPS staff members and the research assistant were available to answer any questions, and the research assistant witnessed the participant's signatures. Parent(s) then completed the patient information forms by hand.

Providers: Clinic providers were invited to participate at the beginning of the study. The research assistant gave those providers that agreed to participate the paper consent forms and reviewed the process with them. New providers who joined the clinic during the study were also invited to participate and were consented in the same manner.

Inclusion and Exclusion Criteria:

- **Inclusion Criteria:** Participants were parents/guardians of children and adolescents (through age 18), who were new patients at the Child and Adolescent Psychiatry Service clinic (CAPS) at Walter Reed Army Medical Center, and the providers who interviewed the participants in our study. All participants had to be English-speaking and writing. Access to a web-enabled personal computer was also required.
- **Exclusion Criteria:** The four exclusion conditions for parents/guardians were as follows: parents of patients who were seen outside the clinic during consultations in the hospital, parents who were non-English speaking, parents of patients seen less than 48 hours after initial contact (crisis/urgent patients), and parents who did not have access to a computer with internet access. Investigators on this study were excluded from participation as well.

**Measurement Tools**

**Parent/Guardian Satisfaction with Intake Form Completion Process**

This study sought to measure parent/guardian satisfaction with one of the following three methods for completing patient intake forms: a web-based automated entry form

completed off-site, the same web-based automated entry form completed at the CAPS clinic and a manual method using traditional paper and pen forms completed in the CAPS clinic. Satisfaction measures were chosen for their demonstrated psychometric properties. Cover sheets were used for all 'paper' survey tracking, so that no identifiable patient information would be associated with participants' responses to the surveys

Satisfaction with the intake format was assessed using a survey adapted from one of the IBM Computer Usability Satisfaction Questionnaires, which is the Computer System Usability Questionnaire (CSUQ) (Lewis, 1995). The CSUQ addresses overall satisfaction with computer system usability (Lewis, 1995). The CSUQ demonstrated good reliability with a coefficient alpha of .89-.95. In addition to the CSUQ, there were additional questions that asked participants to describe their comfort with computer use and the characteristics of their computer system and modem connection. Finally, each survey had a series of demographic questions derived from a literature review on variables associated with client satisfaction (Sitzia & Wood, 1997).

This first parent survey (Parent Survey #1) was given immediately after the patient information forms were completed, but before the initial intake interview. This survey assessed the participant's responses to and satisfaction with completing the patient information forms. There were 2 versions of this survey, version 1 for Groups 1 and 2 called *Satisfaction with Automated Patient Information Forms*, and version 2 for Group 3 called *Satisfaction with Manual Patient Information Forms*.

#### **Parent/Guardian Satisfaction with Clinical Services Provided**

Parent Survey #2 was called *Satisfaction with Clinic Services* and was administered after the clinical interview. It was used to evaluate the parent's satisfaction with the clinic intake process. The 8-item Client Satisfaction Questionnaire (CSQ-8) was used based on its tested validity and reliability in measuring patient satisfaction in primary care and mental health settings (Attkisson & Greenfield, 1996; Larsen, Attkisson, Hargraves & Nguyen, 1979). The psychometric properties of this questionnaire have been extensively evaluated in populations utilizing mental health services. The CSQ-8 demonstrated consistently high levels of internal consistency and reliability with Cronbach's  $\alpha$  coefficients ranging from 0.83-0.94 (Attkisson & Greenfield, 1996; (Larsen, Attkisson, Hargraves & Nguyen, 1979). Several demographic questions were appended to the CSQ-8.

A third parent survey (Parent Survey #1A) called the *Non-Completion Questionnaire* was given to parents assigned to Group 1 who do not complete the forms at home. This survey helped the researchers determine possible reasons why the parent could not or did not complete the forms at home or work.

#### **Provider Satisfaction with Automated System v. Manual System**

Provider satisfaction with the intake system was assessed using 4 surveys constructed in a format based on the Computer System Usability Questionnaire (CSUQ). The CSUQ is from of the IBM Computer Usability Satisfaction Questionnaires (Lewis 1995). Provider Survey #1 (Post-Interview) was given to the provider after each interview with a participating parent, and had questions regarding provider satisfaction with the intake system, patient information, clarity and usefulness of the intake information, extent to which the provider felt prepared for the interview, and amount of time involved in the intake/interview. Provider Survey #2 (Post-Report) had questions regarding provider satisfaction with writing the intake

report, and was given after each time the provider wrote an intake report whether it was online or hand-written. Provider Survey #3 (Initial Satisfaction and Demographics), also from the CSUQ, had an extensive set of questions regarding provider satisfaction with writing the intake report, and was given once, after the provider wrote their first intake report online for the study. Provider Survey #4 (Final Satisfaction), based on the CSUQ, had questions similar to Provider Survey #3, and was given once, after the provider wrote their final intake report for the study.

### **REPORTABLE OUTCOMES**

**Data Analysis:** This study used SPSS® Software, Version 10.0, to gather descriptive statistical evaluations and results of the measurement tools (e.g., frequency, percentages, means).

#### **Results:**

##### ***Parent/Guardian Satisfaction with Intake Form Completion Process (n=30 for each group)***

The results of the parent satisfaction with intake form completion surveys were determined for each group according to method of completing the intake forms. The average time parents spent to complete the intake forms was 88 minutes using the automated system from home or work (group 1), 62 minutes using the automated system in the CAPS clinic (group 2) and 57 minutes using the traditional manual system (group 3). Only 8% of group 1 parents, 65% of group 2 parents and 88% of group 3 parents replied that they would have preferred to complete the forms elsewhere. Most parents who commented stated that they would have preferred to complete the intake forms at home.

Eighty-seven percent of parents in groups 1 and 2 preferred to complete the online forms and 73% of parents in group 3 would have preferred to complete the online forms as well. Approximately 80% of parents in all groups agreed that the information provided on their intake forms would be helpful to the provider. Approximately 80% of parents completing the forms online were comfortable using WAMHIS. Most parents using WAMHIS at home or at work (74%) were confident that WAMHIS was secure, and most parents using WAMHIS at the CAPS clinic (80%) were confident that WAMHIS was secure.

##### ***Parent/Guardian Satisfaction with Clinical Services Provided (n=30 for each group)***

In terms of clinical services provided, parents in groups 1, 2 and 3 spent an average time of approximately 145 minutes, 167 minutes and 150 minutes respectively in the CAPS clinic for the first appointment. Eight-eight percent of group 1 parents, 100% of group 2 parents and 77% of group 3 parents were satisfied to some degree with the clinical services provided. Sixty-two percent of parents in groups 1 and 2, and 77% of parents in group 3 felt that the information provided was useful for the provider. Overall, 70% of parents in group 1 and 77% of parents in group 2 were satisfied using WAMHIS. And only 50% of parents in group 3 were satisfied using the traditional paper/pen version.

##### ***Provider Post-Interview Survey***

Providers with patients in group 1 had an average time of 1970 minutes (approximately 1.4 days) to review the intake forms prior to the actual appointment time. Providers with group 2 parents had an average of 111 minutes (approximately 1.85 hours) and providers with group 3 parents only had an average of 7 minutes to review the intake forms prior to the actual appointment time. The length of interview times was similar for all 3 groups (approximately 104

minutes). This study was interested in determining whether or not the information provided ahead of time (prior to the actual appointment) helped providers prepare for the clinical interview and/or increased clinical efficiency. The results of these measures are shown below:

	<b>% of providers that felt the information provided helped them prepare for interview.</b>	<b>% of providers that felt the information provided increased clinical efficiency.</b>
<b>If parents used WAMHIS at home</b>	91%	94%
<b>If parents used WAMHIS in CAPS</b>	69%	75%
<b>If parents used paper/pen version</b>	56%	50%

***Provider Post-Report Survey***

Providers who used WAMHIS to type up their intake reports spent an average of approximately 65 minutes compared to 70 minutes for providers who did not use WAMHIS to generate their intake report.

***Provider INITIAL Satisfaction with WAMHIS (after First Use) (n=22)***

When providers used WAMHIS for the first time, 23% would have preferred to complete their intake reports on paper. Approximately 80% of providers were confident that WAMHIS was secure and 27% reported encountering many problems using WAMHIS. Overall, 55% of providers were satisfied with the automated system after their first use.

***Provider FINAL Satisfaction with WAMHIS (at end of study period) (n=13)***

When providers used WAMHIS for their final time at the end of the study period, 38.5% would have preferred to complete their intake reports on paper. Approximately 92% of providers were confident that WAMHIS was secure and 23% reported encountering many problems using WAMHIS. Overall, most providers (85%) were satisfied with the automated system after their final use, while the remainder (15%) were neutral in terms of their satisfaction.

**KEY RESEARCH ACCOMPLISHMENTS**

This study was designed to determine the feasibility of a web-based automated health intake system and automated report writer are in the Child and Adolescent Psychiatry Service clinic and how satisfied parents and providers are with the automated system compared to the manual system. The study aimed to ascertain the feasibility by addressing the following objectives: (1) to determine how satisfied parents/guardians are with the Web-based Automated Mental Health Intake System (WAMHIS) compared to the standard manual (paper/pen based) intake system, (2) to determine how satisfied providers are with WAMHIS versus the manual system, (3) to identify problems encountered by parents and providers when using WAMHIS, and (4) to examine how satisfied providers are with the process of completing computer-generated reports and how the system affects the providers' ability to do write-ups.

Based on the research objectives, key research accomplishments included: (1) determining that there was a higher satisfaction rate among parent participants using WAMHIS compared to parents who used the standard paper/pen system, (2) determining that there was a

higher satisfaction rate among provider participants using WAMHIS compared to providers who used the standard paper/pen system, (3) determining that parents preferred using WAMHIS at home or work to complete the lengthy intake forms rather than arriving at the clinic 1 to 1.5 hours before the actual appointment time, (4) increasing clinical efficiency and preparation time for providers by providing intake forms at least a day before the actual appointment, and (5) identifying challenges to the implementation of the automated system and initiating methods to alleviate such challenges.

Technical and programmatic system challenges were encountered throughout the study time period. Technical challenges included the following: (1) frequent WRAMC server outages, (2) unappealing visual appearances of the system, (3) lack of spell check function, (4) lack of formatting capabilities for multiple sibling cases, and (5) issues associated with concept and communication among different technical experts (i.e., programmers and clinicians). Programmatic challenges included the following: (1) insufficient time limits for providers when entering data, (2) cumbersome process of obtaining consent from parents, (3) functional changes within the research team during the study time period, and (4) provider hesitation for change. Many of these challenges were addressed and problems were corrected based on parent and provider feedback, but continuous quality improvement is ongoing.

Some limitations to the study existed during the study time period. Initially, the design of the automated system generated provider assessment reports that appeared unorganized and difficult to read due to print layout and font size. Providers found it difficult to distinguish between their notes and the parents' notes. Programming adjustments were made to address these issues and provider satisfaction with the system improved.

Another technical challenge of the study was the amount of time allotted to providers to complete each step of their patient reports. The time limit was initially set to 10 minutes per step, but providers found this amount of time to be insufficient and created many problems. For example, providers would enter their clinical assessments into WAMHIS, but the time limit frequently "booted" them off the system without saving the information entered. This time allotted per step was eventually increased to 60 minutes per step.

The server running WAMHIS consistently limited the capabilities of the automated system due to the lack of access to the Integrated Clinical Database (ICDB). The original design of the system intended e-Portal provider access to ICDB information. However, the ICDB was moved to the National Naval Medical Center, thereby creating access problems due to firewall issues. As a temporary fix, a copy of the ICDB was installed on a WRAMC "test" server until the firewall issues were resolved. Subsequently, the "test" server would often have problems causing the ICDB to go "down" and would then inhibit access to WAMHIS. As a result, the programmer disconnected the link between the ICDB and WAMHIS, allowing access to WAMHIS. The server difficulties have remained an ongoing problem. To address these, the Telemedicine Directorate is currently in the process of installing and migrating new application servers. Although the new application servers are expected to improve the server problems from a WRAMC Department of Information Management perspective, ICDB connectivity remains an issue being worked by both Health eForces and Telemedicine. The inclusion of a mechanism for patient and provider feedback in this study has been instrumental in identifying technical and programmatic problems and providing incentive for improvement.

## CONCLUSIONS

To our knowledge this Telemedicine research protocol was the first of its type in Behavioral Health Services. This feasibility study evaluated the potential use of a web-based automated mental health record permitting parents to provide pertinent clinical background information prior to the initial appointment via the Internet. WAMHIS helped providers better prepare for patient appointments, increased the amount of time to review pertinent clinical data from parents prior to the actual appointment time and improved clinical efficiency, thus improving and refining the differential diagnosis. Furthermore, WAMHIS incorporated computer-scored outcomes research measures. Use of this system resulted in increased clinical efficiency by several measured parameters. For example, clinicians spent less time scoring the rating scales prior to the diagnostic interview. Automatic scoring allowed providers to ensure that baseline clinical data was collected and allowed monitoring of clinical improvements of their patients.

Parents (over 70%) completing the online forms were more satisfied compared to parents completing the paper forms. After their first use of WAMHIS, providers were moderately satisfied with the automated system (55%). Improvements to WAMHIS were ongoing throughout the study time period, so that by the end of the study, providers had much higher satisfaction with the automated system (85%). There was a decrease in patient/parent time at the clinic for parents who completed the online forms from home by about 15 minutes, and a reduction in time spent waiting to see the provider due to paperwork. When parents used WAMHIS at home, providers noted an increase in clinical efficiency in 94% of the diagnostic interviews and most providers felt that having the paperwork ahead of time helped them prepare for the actual appointment. When parents used WAMHIS to complete the intake forms, providers often reported increased thoroughness of the clinical data, particularly when only one parent was able to come to the actual appointment. There was an improvement in appointment compliance (i.e., zero no-show rate for parents who completed the forms at home using WAMHIS) and perceived improvement in therapeutic alliance as well. Data analysis suggests that the web-based system has positively impacted quality of and access to care, and has enhanced outcomes measurement and clinical practice objectives by 20 percent. After completing data collection, the CAPS clinic at WRAMC began using WAMHIS as routine practice for the new patient intake process. This study serves as a model for future web-based initiatives in mental health care environments.

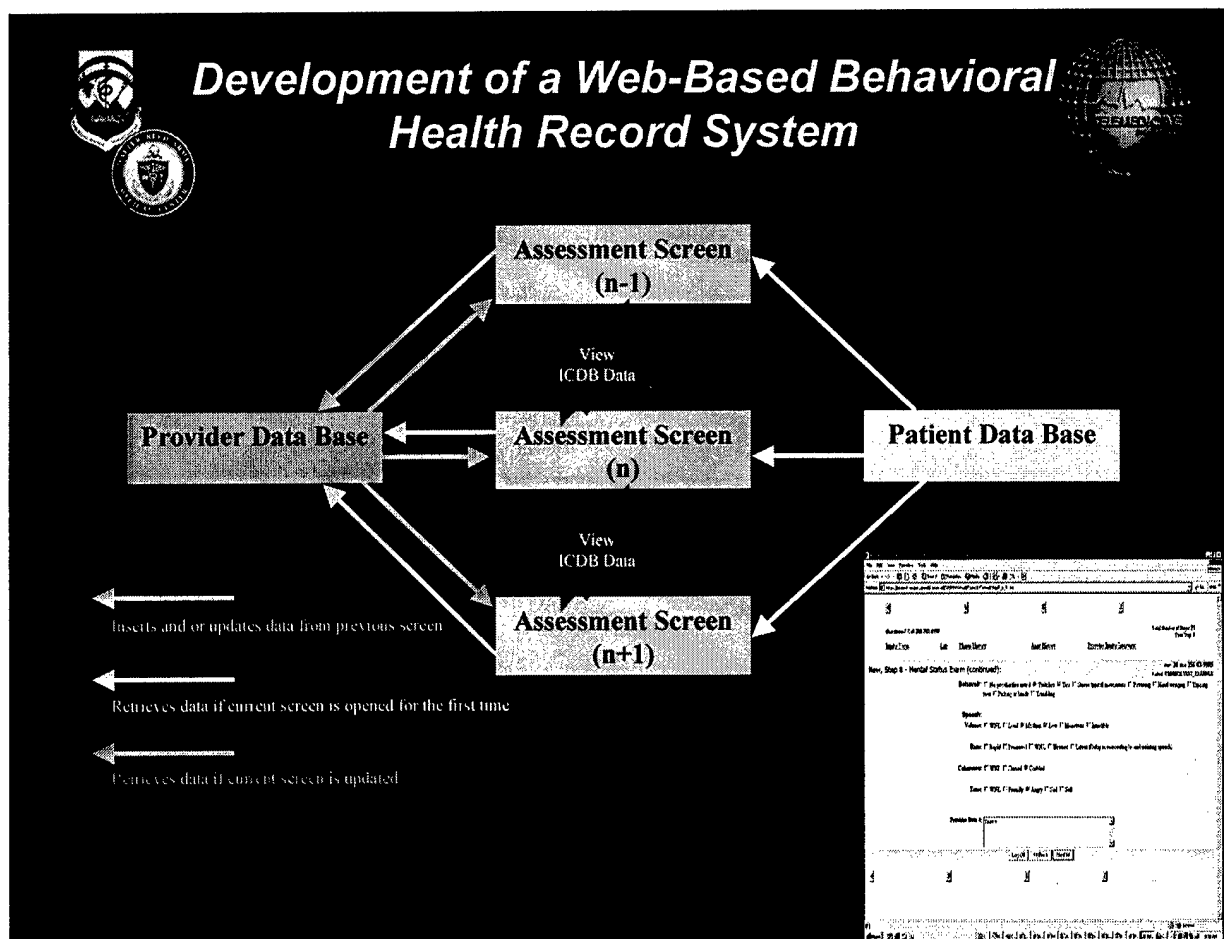
WAMHIS is now one component of a comprehensive web-based behavioral health record that WRAMC and the Telemedicine Directorate are developing. The "adult" record is being used throughout the NARMC, where WRAMC delivers telebehavioral health services. Furthermore, the Office of the Surgeon General CIO has identified telebehavioral health as its third priority (behind teledermatology and telepathology) for AMEDD-wide adoption. As a result of the demonstrated utility of these automated systems, WRAMC is submitting a Venture Capital Improvement Telebehavioral Health Initiative designed to improve access and reduce outsourced behavioral health costs throughout the NARMC. This direct-care initiative integrates video teleconferencing with the web-based record technology to deliver services. Once the NARMC initiative demonstrates that the clinical model produces the projected 'Return On Investment', the TATRC Telemedicine Program Office will review the initiative for AMEDD-wide adoption. Discussion continues with HeatheForces about the feasibility of incorporating WAMHIS through their interface.



Overall, this study produced a preliminary assessment of the feasibility of using an automated system in a clinical setting. The findings of this study have and will continue to guide automated system design improvements and to serve as a model for other such behavioral health intake systems.

## APPENDIX A: TECHNICAL SUMMARY

As illustrated below, the application continuously updates both the patient and provider databases as the user advances from screen to screen. The WAMHIS application is written in ColdFusion and operates on a SQL database composed of a complex series of relational tables and integrates both "patient" reported and provider reported clinical information. As this application matured throughout the clinical investigation period, the application's potential became apparent. Current plans will convert the WAMHIS application to ASP.NET and operate on an Oracle database similar to Health eForces.



**APPENDIX B: FUNDED PERSONNEL AND PARTICIPANTS**

**Personnel receiving pay from the research effort of this protocol:**

Sona Patel MPH (Research Associate)  
Sarah Rosquist BS  
Anna Crane  
Scott Mann

**Other participants:**

COL Ryo Sook Chun, MD, Chief, Child and Adolescent Psychiatry Service  
Donna L. Edison, DO  
MAJ Anthony L. Cox, MSW  
COL Stephen J. Cozza, MD, Chief, Department of Psychiatry  
William G. Parker, MS, Project Officer  
Grigorii Gadiyak, PhD  
Daisy Dewitt, Deputy Director, Telemedicine Directorate

## APPENDIX C: WAMHIS APPLICATION SCREENSHOTS

### Clinician's View of Completed Patient Intake Forms:

WWW Telemedicine Consult - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss SideStep

Address https://consult.wamc.amedd.army.mil/WAMHIS/CAPS/Consult/ConsultStep\_Child6\_7\_9.cfm

3 4 5

Questions? Call 202-782-5983

Total Number of Steps: 35  
Your Step: 6

[View Intake Form](#) [Lab](#) [Appt History](#) [Pharm History](#) [View Provider Intake Assessment](#)

**New, Step 6: Medical History**

FMP: 01 Sponsor SSN: 111-11-1111  
Patient: Junior Sample

Intake Interview Date: (mm/dd/yyyy) 04/22/2003 at (hr:min)(00:00) 09:00

Information Migrate from Intake Form:  
Step 14: Physical Assessment

Name of primary care physician: Dr. Primary Care

Date of last physical exam (mm/yyyy) 02/2003

Done Start Internet

Walter Reed Health Care ... WWW Telemedicine ... Microsoft PowerPoint - 03 ... 8:33 AM

WWW Telemedicine Consult - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss SideStep

Address https://consult.wamc.amedd.army.mil/WAMHIS/CAPS/Child/ConsultStepCHA1\_2\_7\_9.cfm

**Step 8: How Can We Help?**

What is (are) your reason(s) for seeking help today? **My son's grades have been falling and he gets angry very easily.**

How long has the child/adolescent been experiencing this (these) problems? **For about 1 month**

Has the child/adolescent had difficulties or troubles like this before? **No**

If "Yes", please describe:

What prior attempts have been made to get help with this situation? **None, School**

Has the child/adolescent recently experienced or presently have any of the following? **School avoidance, Running away from school, Recent Parental Deployment, Depression**

**Step 9: Continue Presenting Problem**

Has the child/adolescent recently experienced or presently have physical pain or discomfort? **No**

How would you rate pain on a scale of 1-10?

What do you hope to accomplish at the initial appointment? **I hope we can find the cause of this behavior and fix it.**

In what way(s) do you believe the clinic can be of help to you and the child/adolescent? **Individual therapy for child, Family therapy**

Log Off << Back Next >>

Done Start Internet

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## APPENDIX C: WAMHIS APPLICATION SCREENSHOTS

### Clinician's View of Provider Intake Assessment:

WWW Telemedicine Consult - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss SideStep

Address: [https://consult.wramc.amedd.army.mil/WAMHIS/CAPS/adm/PrintNewConsultViewCHD7\\_9.cfm?ConsultID=341](https://consult.wramc.amedd.army.mil/WAMHIS/CAPS/adm/PrintNewConsultViewCHD7_9.cfm?ConsultID=341) Go Links

### CAPS: WAMHIS System Assessment

Interview Type: Routine Patient: Sample, Junior Date/Time Intake Interview: 22-Apr-03 at 09:00 AM	Status: WAMHIS, New Child Assessment FMP: 01 Sponsor SSN: 111-11-1111
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**Step 1: Patient Information**

Facility: Walter Reed Army Medical Center, WRAMC      Appointment Type: Routine

**Step 2: Patient Information (continued)**

Last Name: Sample Date of Birth (mm/dd/yyyy): 01/01/1997    Age: 6 TRICARE Status of patient: Prime Referred by: Parent Relationship to patient: Biological Mother	First Name: Junior MI Gender: M If Prime, where: Name of person completing form: Test Sample
--	---

**Step 3: Chief Complaint:**

What is (are) your reason(s) for seeking help today?      My son has been acting up more frequently than usual. He fights with other kids at school and has been sent home 4 times in the last month. At home, my son won't listen to me and often screams/shouts at me. He has become more aggressive and even kicked me in the leg the other day when I wouldn't let him have dessert because he wouldn't finish his vegetables. He gets angry easily and I think he has become more violent. He won't listen to me and gets "snappy" with me.

How long has the child/adolescent been experiencing this (these) problem(s)?      He has been acting up for about 6 weeks.

Provider Note for chief complaint:      6 y.o. male with increased aggressive behavior in last 6 weeks.

Done      Internet      1:41 PM

WWW Telemedicine Consult - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss SideStep Links

**Step 30: Mental Status Examination (continued)**

Does the patient have thoughts of suicide?      No  
 If "Yes", explain      Pt did not voice any SI.

Does the patient have thoughts of homicide?      No  
 If "Yes", explain      Pt did not voice any HI.

Insight:      Poor  
 Judgement:      Poor

**Step 31: Formulation**

10 yo white male, dependent of retired D-5, who was sent to the CAPS clinic by the pt's school nurse. Biologically, the pt has a 3 year hx of ADHD and reading/writing/math learning disabilities and has been tried on multiple stimulants with minimal results. Psychologically, the pt has been having difficulty at school and has been getting into fights and arguments with others and has problems stealing and lying. Socially, the pt is currently alternating time with his mother one weekend and his father the next who have undergone a divorce. The pt has gotten into trouble at school necessitating disciplinary action.

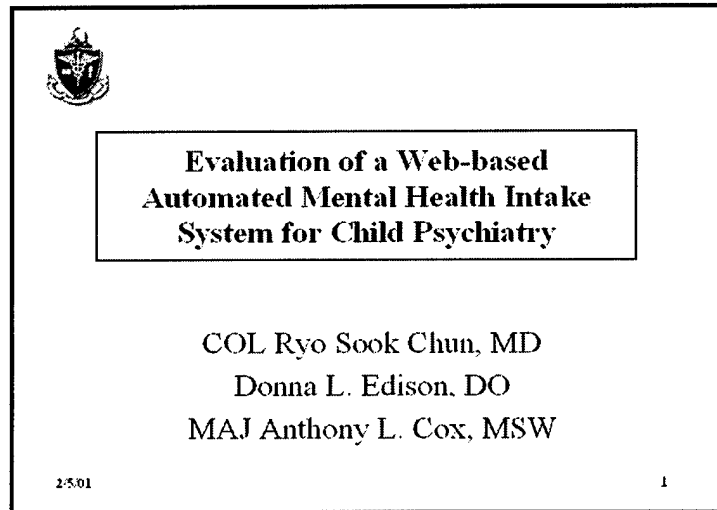
**Step 32: Preliminary Diagnoses**

Axis I	ADHD (by history) R/O Bipolar D/O vs ODD R/O LD
Axis II	deferred
Axis III	none
Axis IV	school stressors, arguments with family members, parents separation and divorce
Axis V	GAF= 70

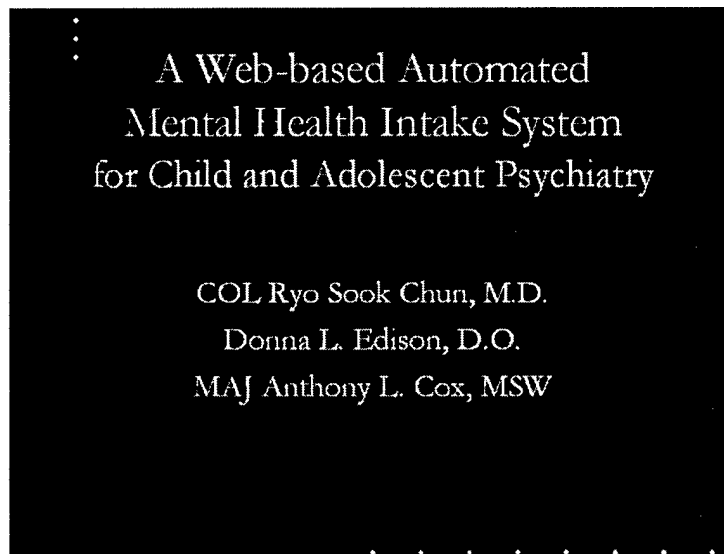
**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS**

**PRESENTATIONS:**

The 6<sup>th</sup> Annual Meeting and Exposition of the American Telemedicine Association, 2001:

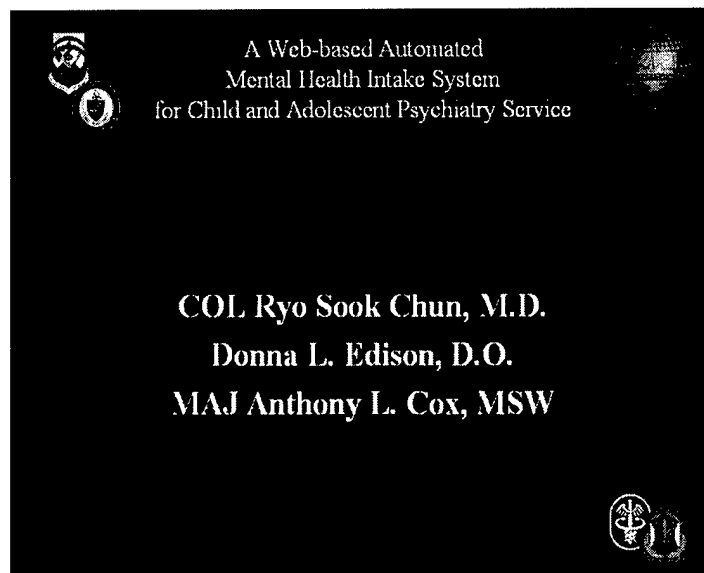


Behavioral Health Meeting, 2001:

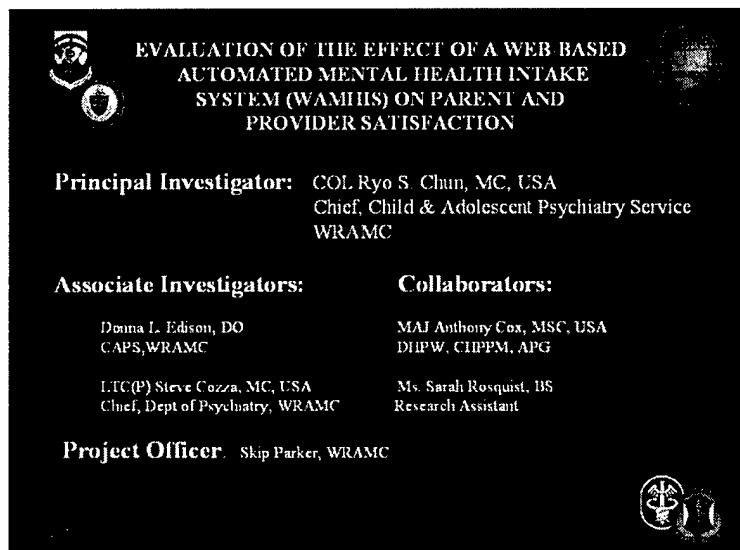


**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS (continued)**

The 7<sup>th</sup> Annual Meeting and Exposition of the American Telemedicine Association, Los Angeles, CA, 2002:




General's Briefing



**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS (continued)**

The 8<sup>th</sup> Annual Meeting and Exposition of the American Telemedicine Association, Orlando, FL, April 2003.




A Web-based Automated  
Mental Health Intake System  
for Child and Adolescent Psychiatry Service

**Principal Investigator:** COL Ryo Sook Chun, M.D.  
Chief, Child & Adolescent  
Psychiatry Service (CAPS), WRAMC

<b>Associate Investigators:</b>	<b>Collaborators:</b>
Donna Edison, D.O. CAPS, WRAMC	MAJ Anthony Cox, MSC, USA DIPW, CHPPM, APG
COL Steve Cozza, MC, USA Chief, Dept. of Psychiatry, WRAMC	Ms. Sona Patel, BS, MPH(c) CAPS, Research Assistant

**Project Officer:** Skip Parker, WRAMC

General's Briefing



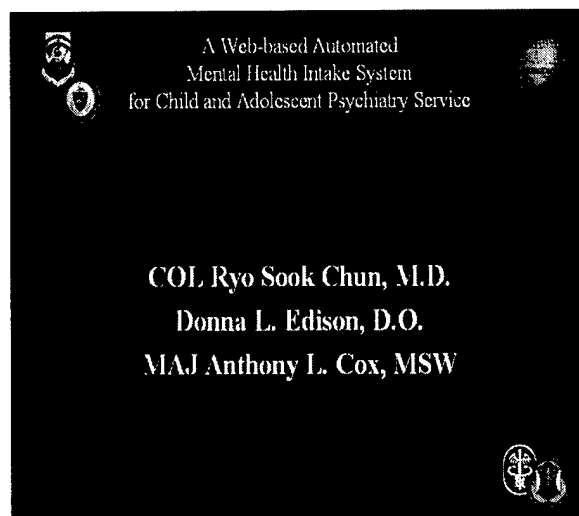
**A Web-based Automated  
Mental Health Intake System for  
Child and Adolescent Psychiatry  
Service**

*30 April 2003*

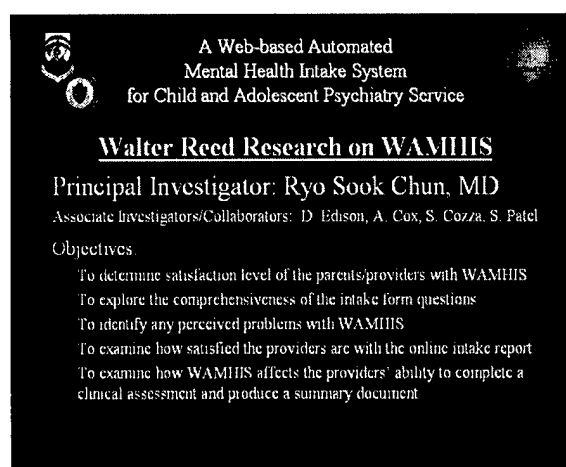
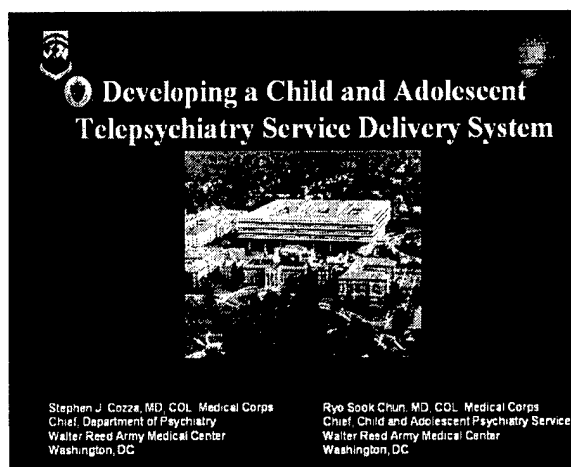


**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS (continued)**

The 4<sup>th</sup> Annual Meeting of the American Academy of Child and Adolescent Psychiatry, San Francisco, CA, October 2002.

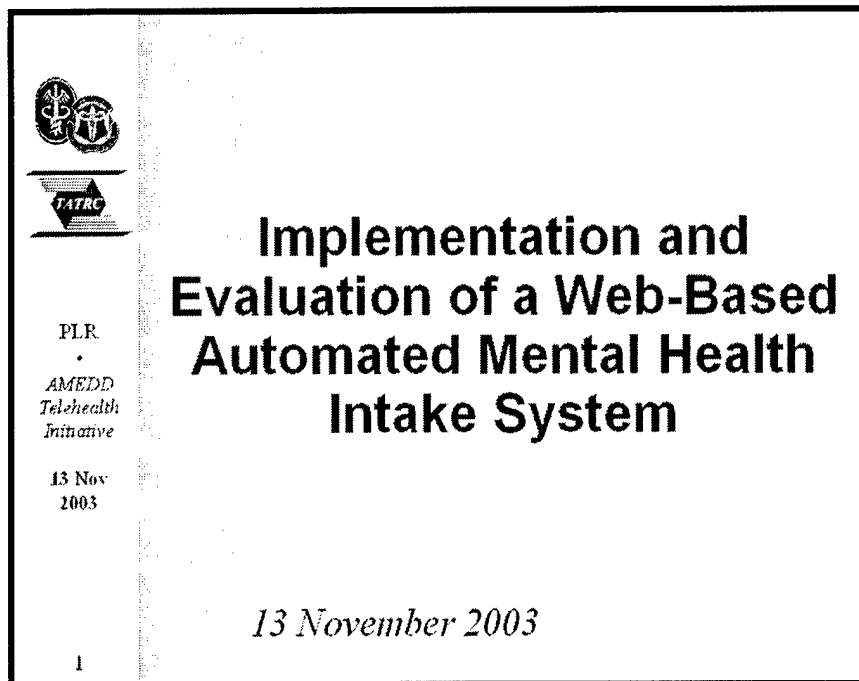


The 5<sup>th</sup> Annual meeting of the American Academy of Child and Adolescent Psychiatry, Miami, Florida, October 2003:



**APPENDIX D: PRESENTATIONS, POSTERS, PUBLICATIONS (continued)**

The Telemedicine and Advanced Technology Research Center Product Line Review, Frederick, MD, November 13, 2003.



**PUBLICATIONS: Abstracts**

**Chun RS.** Web-based Automated Mental Health Intake System (WAMHIS). In: Telemedicine and e-Health Journal, Spring 2003.

**Chun RS.** Web-based Automated Mental Health Intake System (WAMHIS). In: Telemedicine and e-Health Journal, Summer 2002.